APPLICATION

FOR

UNITED STATES OF AMERICA

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SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that I,

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have invented certain improvements in

"SWASH PLATE FOR AXIAL PISTON PUMP"

of which the following description in connection with the accompanying drawings is a specification, like reference characters on the drawings indicating like parts in the several figures.

The present invention relates to a swash plate for axial piston pump.

BACKGROUND OF THE INVENTION

Currently, in the field of axial piston pumps there are three main constructive solutions: pumps with an inclined swash plate and an aligned oscillating cylinder block, pumps with a perpendicular swash plate and an inclined cylinder block, and pumps with an oscillating swash plate and an aligned fixed cylinder block.

With reference to this last constructive solution, the pump is constituted by a pump body in which the cylinder block is arranged so that it is aligned with the rotation axis of the oscillating swash plate.

The pistons are arranged inside the cylinder block and their external head is in contact with the thrust bearing of a roller bearing that is arranged on an annular surface portion that is inclined with respect to the rotation axis of the swash plate and is formed on the swash plate.

The pistons are associated with return springs for retracting outward the cylinder block.

The swash plate is provided centrally with a hub on which the rotation pivot of the swash plate is locked.

A crown gear is further locked on the pivot, substantially on the opposite side with respect to the swash plate, and meshes with a pinion that is functionally connected to the electric motor of the pump.

Although this pump configuration has been available commercially for some time and is appreciated because of its characteristics, it has aspects that can be improved.

For example, the coupling between the swash plate, the pivot and the crown gear is particularly difficult.

During the assembly of these components it is in fact necessary to try to reduce the concentricity errors produced during mutual coupling.

These concentricity errors cannot always be eliminated acceptably

and lead to imbalances of the rotating masses, with consequent problems in terms of vibration, bearing wear, et cetera.

Moreover, these components are made of metallic material (the swash plate is cast from a zinc-manganese-aluminum alloy and the crown gear is made of sintered steel) and their manufacturing costs are not negligible with respect to the total manufacturing cost of the entire pump.

SUMMARY OF THE INVENTION

The aim of the present invention is to provide an oscillating swash plate for an axial piston pump that solves the problems described above in known types.

Within this aim, an object of the present invention is to provide an oscillating swash plate for an axial piston pump that reduces the concentricity errors produced in the coupling of the components of the pump and reduces the rotating masses.

Another object of the present invention is to provide an oscillating swash plate for an axial piston pump that can be manufactured at a lower cost than currently manufactured swash plates.

Another object of the present invention is to provide an oscillating swash plate for an axial piston pump that can be manufactured with known systems and technologies.

This aim and these and other objects that will become better apparent hereinafter are achieved by an oscillating swash plate for an axial piston pump comprising a rotating disk-like body in which an annular seat is provided that is inclined with respect to the rotation axis of said disk-like body and on which it is possible to accommodate sliding means for the heads of the axial pistons, the swash plate being characterized in that it comprises, monolithically with said disk-like body, a toothed circumferential portion that is coaxial to the rotation axis and can be coupled kinematically to a gear of the pump, said pump being functionally connected to motor means.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the present invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a partially sectional view of the portion of the pump where the swash plate acts;

Figure 2 is an exploded view of the portion of the pump where the swash plate acts;

Figure 3 is a plan view of a swash plate according to the invention, which can be used in a pump that is different from the one shown in the preceding figures;

Figure 4 is a sectional view, taken along the line III-III of Figure 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the figures, an oscillating swash plate for axial piston pumps according to the invention is generally designated by the reference numeral 10.

The swash plate 10 is accommodated inside a pump body 11 and is of the inclined-plane type.

In practice, the swash plate 10 is formed by a rotating disk-like body 10a on which a central hub 12 is formed.

The central hub 12 has an axial through hole for coupling to a rotation pivot 13 that is pivoted to the pump body 11.

The disk-like body 10a has an annular seat 14 that is inclined with respect to the rotation axis 15 of said disk-like body and is formed on two different mutually parallel levels 14a and 14b.

Means for the sliding of heads 19 of axial pistons 20 of the pump formed by the body 11 are accommodated in the annular seat 14.

The pistons 20 are inserted slidingly within a cylinder block 20a, which is fixed to the pump body 11 by way of brackets, and are associated

with return springs 20b.

Said sliding means are constituted by a first thrust bearing 16 on which a roller cage 17 rests; in turn, a second thrust bearing 18 rests on the roller cage 17 and is directly in contact with the heads 19 of the pistons 20.

The swash plate 10 comprises, on the peripheral region of the disk-like body 10a, which is formed monolithically therewith, a toothed circumferential portion 21 that is coaxial to the rotation axis 15.

The toothed circumferential portion 21 mates kinematically with an actuation gear 22, for example a pinion, that is functionally connected to pump motor means 30, such as for example an electric motor, by way of a shaft 23.

Advantageously, the swash plate 10 is made of plastics and is preferably injection-molded.

Figures 3 and 4 illustrate an embodiment of a swash plate (designated by the reference numeral 110) that can be used in a pump body that is different from the one described earlier.

Likewise, the swash plate 110 comprises, on the peripheral region of a disk-like body 110a and formed monolithically therewith, a toothed circumferential portion 121 that is coaxial to a rotation axis 115.

In practice it has been found that the invention thus described solves the problems noted in known types.

It should be noted that a single component has been provided which comprises both the swash plate and the crown gear.

This solution allows to eliminate the problems related to concentricity errors between the swash plate and the ring gear and to simplify production, eliminating the step for assembling said components (in addition to eliminating assembly costs).

Moreover, providing the swash plate and the crown gear monolithically leads to a reduction of the rotating masses, decreasing all the related negative phenomena, including stresses on the bearings, vibrations,

and noise.

It should be noted that making the invention out of plastics also leads to a reduction in rotating masses and in any case to a production cost of the swash plate that is lower than known types of plate.

In practice, the materials employed, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

The disclosures in Italian Utility Model Application No. PD2003U000013 from which this application claims priority are incorporated herein by reference.